Effects of Sudden Commencement on the Ionosphere: PFISR Observations and SWMF Simulation

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Ionospheric Response to 2015 St. Patrick Day Sudden Commencement

OMNI solar wind and Sym-H

PFISR and magnetometer

PFISR vertical profiles before and after the sudden commencement

- PFISR observed lifting of the F region ionosphere;
- transient field-aligned ion upflow;
- prompt but short-lived ion temperature increase;
- subsequent F region density decrease;
- persistent electron temperature increase.
FACs and Convection Pattern from Coupled BATSRUS MHD+CRCM Run

SWMF:
- used to characterize the SC-induced current, convection, and magnetic perturbations;
- provides a global context for linking localized PFISR observations to large-scale dynamic processes in the MI system.
Preliminary Results from BATSRUS +CRCM Driven GITM Run

- GITM was driven by BATSRUS+CRCM output in order to study the global ionosphere response to SC.
- Preliminary results show rapid heating of ionosphere plasma and F-region density depletion.
- We will continue quantify the various processes that would create such rapid density loss.
Summary and Conclusions

- During the SC of the 17 March 2015 storm, PFISR observed lifting of the F region ionosphere, large and transient field aligned ion upflow (type-1), prompt but short-lived ion temperature increase, F region density decrease and persistent electron temperature increase.
- The global BATSRUS MHD simulation revealed the distribution of large-scale FACs and their evolution and propagation through the polar cap.
- The MHD results are used to drive GITM to study the global effects of SC-related electrodynamics. Preliminary results show good agreement with radar observations.